

## Introduction

The set of worksheets included in this file will enable stormwater permit applicants to comply with, and local governments to administer, the nutrient loading requirements of the Tar-Pamlico Stormwater Rule, 15A NCAC 2B .0258. The file contains a set of worksheets for estimating nitrogen and phosphorus export from a development project prior to and following development, and following the installation of best management practices (BMPs) on the development. Supporting information on the design of the worksheets can be found in the document, *Tar-Pamlico River Basin: Model Stormwater Program for Nutrient Control*, available from local governments implementing the stormwater rule and the NC Division of Water Quality staff contact for the Tar-Pamlico nutrient strategy, in the Nonpoint Source Unit of the central DWQ office, Raleigh, NC. The information may also be downloaded from the Division of Water Quality's Tar-Pamlico web page at <http://h2o.enr.state.nc.us/nps/tarpam.htm>.

This file contains worksheets with the following elements:

1. Definitions of Land Use Terms Used in Spreadsheets (this page)
2. Residential Worksheet when Footprints are not Shown (1 pg.)
3. Export Calculation Worksheet for Piedmont Communities (1 pg.)
4. BMP Removal Calculation Worksheet for Piedmont Communities (3 pp.)

## Definitions of Land Use Terms Used in Spreadsheets

**Transportation impervious:** The portion of the development that is taken up by roads, driveways, parking areas, wash pads or any other facility designed for vehicular use, maintenance or storage. Transportation impervious includes areas covered in pavement, gravel, pavers and dirt.

**Roof impervious:** The portion of the development that consists of roofs of buildings and garages that serve single-family homes. Commercial parking garages shall be considered as transportation impervious.

**Managed pervious:** The portion of the development that consists of vegetated areas that the landowner could manage by mowing, logging, applying fertilizer, etc. Although residential development may include pervious areas that are initially undisturbed, these areas must be considered as managed pervious (instead of wooded pervious) unless they have conservation easements or another mechanism to insure they will not be managed. Also, the land in Zone 2 (the outer 20 feet) of a protected riparian buffer must be considered as managed pervious area unless it is protected by a conservation mechanism.

**Wooded pervious:** The portion of the development that consists of forested areas that are permanently protected by a conservation easement or other binding conservation mechanism. Also, wetlands and the land in Zone 1 of a protected riparian buffer (the first 30 feet adjacent to a stream) may be considered as wooded pervious area.

**Residential Worksheet when Footprints are not Shown** . . .

*Use this worksheet when building footprints are not known to determine the acreage in each of the four categories - transportation impervious, roof impervious, managed pervious, and wooded pervious - in the development. You will need these acreages for both the "Export before BMPs" and "Export after BMPs" worksheets. For the "Export after BMPs" worksheet, you will need to subtract the acreage occupied by BMPs from the managed pervious acreage produced by this worksheet. Also for the "Export after BMPs" worksheet, if the development contains more than one catchment, use this worksheet for each catchment.*

Project Name: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 By: \_\_\_\_\_

**Directions:**

- > In the two green spaces in the box below, enter the average lot size and the percent of the right-of-way that is impervious within the development.
- > In the table below, for the type of land cover listed for each column, enter acreages in the green boxes beneath.
- > In the "Lot Area" column, be sure to enter acreage within lots that is protected by a conservation easement, the Tar-Pamlico buffer rule, or wetland rules in the green box in the lower lefthand corner (enter "0" if there is none). If lots are drawn to exclude protected lands that are part of the total development acreage, enter the acreage of those protected lands as wooded pervious in the "Community Areas" column.
- > The spreadsheet will compute all values in the light blue shaded boxes.
- > NOTE: In the "Community Areas" column, you will need to ensure that the various component acreages sum to the value in the "TOTAL" box at the top. The spreadsheet will not correct for inconsistencies. Any inconsistency between the total value and the sum of individual acreages will carry over to column (5).

Average lot size =  ac (Must show building footprints if lot size < 0.13 ac.)  
 % impervious in right-of-way =  %

(1) Type of Land Cover	(2) Lot area (ac)	(3) Right-of-way area (ac)	(4) Community areas (ac)	(5) Sum of Columns (2), (3), and (4)
<b>TOTAL</b>				
Transportation impervious				
Roof impervious				
Managed pervious				
Wooded pervious				



**Piedmont of the Tar-Pamlico River Basin:**

Includes Oxford, Henderson, Rocky Mount and Tarboro as well as Franklin, Nash and Edgecome Counties

**Total Nitrogen and Total Phosphorus Loading Calculation Worksheet (Automated)**

Project Name: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 By: \_\_\_\_\_ Checked By: \_\_\_\_\_

**Directions (same for pre-development and post-development tables):**

- > Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the values in light blue.
- > Compare total areas of development in pre- and post- tables for consistency (bottom of column (2)), and also for consistency with the site plans. If all of these values are not the same, there is an error that must be corrected.
- > Unless drainage onto the development from offsite is diverted around or through the site, offsite catchment area draining in must be included in the acreage values and treated.

**Pre-development:**

(1) Type of Land Cover	(2) Area (acres)	(3) S.M. Formula (0.46 + 8.3I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious			2.60		0.19	
Roof impervious			1.95		0.11	
Managed pervious (lawn/landscaped)			1.42		0.28	
Managed pervious (cropland)			4.23		1.23	
Managed pervious (pasture)			2.04		0.62	
Wooded pervious			0.94		0.14	
Fraction Impervious (I) =			TN Loading (lb/yr) =		TP Loading (lb/yr) =	
Total Area of Development =			TN Exp. Coeff. (lb/ac/yr) =		TP Exp. Coeff. (lb/ac/yr) =	

**Post-development:**

(1) Type of Land Cover	(2) Area (acres)	(3) S.M. Formula (0.46 + 8.3I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious			2.60		0.19	
Roof impervious			1.95		0.11	
Managed pervious			1.42		0.28	
Wooded pervious			0.95		0.14	
Fraction Impervious (I) =			TN Loading (lb/yr) =		TP Loading (lb/yr) =	
Total Area of Development =			TN Exp. Coeff. (lb/ac/yr) =		TP Exp. Coeff. (lb/ac/yr) =	

**Note:** The nutrient loading goals are 4.0 lb/ac/yr for TN and 0.4 lb/ac/yr for TP. If the post-development nutrient loading is below these levels, then no BMP is necessary. Otherwise, the next worksheet calculates post-development TN and TP loadings after BMPs are installed.

**Piedmont of the Tar-Pamlico River Basin:**

Includes Oxford, Henderson, Rocky Mount and Tarboro as well as Franklin, Nash and Edgecome Counties

**BMP Removal Calculation Worksheet (Automated)**

Project Name: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 By: \_\_\_\_\_ Checked By: \_\_\_\_\_

**Directions:**

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates		TN	TP	Design Standard
	Wet Detention Pond	25	40	NC BMP Manual
	Stormwater Wetland	40	35	NC BMP Manual
	Sand Filter	35	45	NC BMP Manual
	Bioretention	35	45	NC BMP Manual
	Grass Swale	20	20	NC BMP Manual
	Vegetated Filter Strip w/ Level Spreader	20	35	NC BMP Manual
	Dry Detention	10	10	NC BMP Manual

**Catchment I:**

Total acreage of catchment 1 =	<input type="text"/>	ac	First BMP's TP removal rate =	<input type="text"/>	%
First BMP's TN removal rate =	<input type="text"/>	%	Second BMP's TP removal rate =	<input type="text"/>	%
Second BMP's TN removal rate =	<input type="text"/>	%	Third BMP's TP removal rate =	<input type="text"/>	%
Third BMP's TN removal rate =	<input type="text"/>	%	TOTAL TP REMOVAL RATE =	<input type="text"/>	%
TOTAL TN REMOVAL RATE =	<input type="text"/>	0		<input type="text"/>	0

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.46 + 8.3I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	<input type="text"/>		2.60	<input type="text"/>	0.19	<input type="text"/>
Roof impervious	<input type="text"/>		1.95	<input type="text"/>	0.11	<input type="text"/>
Managed pervious	<input type="text"/>		1.42	<input type="text"/>	0.28	<input type="text"/>
Wooded pervious	<input type="text"/>		0.94	<input type="text"/>	0.14	<input type="text"/>
Area taken up by BMP	<input type="text"/>		1.95	<input type="text"/>	0.11	<input type="text"/>
Fraction Impervious (I) =	<input type="text"/>		Pre-BMP TN Load (lb/yr) =	<input type="text"/>	Pre-BMP TP Load (lb/yr) =	<input type="text"/>
Total Area of Development =	<input type="text"/>		Pre-BMP TN Export (lb/ac/yr) =	<input type="text"/>	Pre-BMP TP Export (lb/ac/yr) =	<input type="text"/>
			Post-BMP TN Load (lb/yr) =	<input type="text"/>	Post-BMP TP Load (lb/yr) =	<input type="text"/>
			Post-BMP TN Export (lb/ac/yr) =	<input type="text"/>	Post-BMP TP Export (lb/ac/yr) =	<input type="text"/>

**Catchment 2:**

Total acreage of catchment 2 =  ac  
 First BMP's TN removal rate =  %  
 Second BMP's TN removal rate =  %  
 Third BMP's TN removal rate =  %  
 TOTAL TN REMOVAL RATE =  %

First BMP's TP removal rate =  %  
 Second BMP's TP removal rate =  %  
 Third BMP's TP removal rate =  %  
 TOTAL TP REMOVAL RATE =  %

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.46 + 8.3I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	<input type="text"/>	<input type="text"/>	2.60	<input type="text"/>	0.19	<input type="text"/>
Roof impervious	<input type="text"/>	<input type="text"/>	1.95	<input type="text"/>	0.11	<input type="text"/>
Managed pervious	<input type="text"/>	<input type="text"/>	1.42	<input type="text"/>	0.28	<input type="text"/>
Wooded pervious	<input type="text"/>	<input type="text"/>	0.94	<input type="text"/>	0.14	<input type="text"/>
Area taken up by BMP	<input type="text"/>	<input type="text"/>	1.95	<input type="text"/>	0.11	<input type="text"/>
Fraction Impervious (I) =	<input type="text"/>	<input type="text"/>	Pre-BMP TN Load (lb/yr) =	<input type="text"/>	Pre-BMP TP Load (lb/yr) =	<input type="text"/>
Total Area of Development =	<input type="text"/>	<input type="text"/>	Pre-BMP TN Export (lb/ac/yr) =	<input type="text"/>	Pre-BMP TP Export (lb/ac/yr) =	<input type="text"/>
	<input type="text"/>	<input type="text"/>	Post-BMP TN Load (lb/yr) =	<input type="text"/>	Post-BMP TP Load (lb/yr) =	<input type="text"/>
	<input type="text"/>	<input type="text"/>	Post-BMP TN Export (lb/ac/yr) =	<input type="text"/>	Post-BMP TP Export (lb/ac/yr) =	<input type="text"/>

**Catchment 3:**

Total acreage of catchment 3 =  ac  
 First BMP's TN removal rate =  %  
 Second BMP's TN removal rate =  %  
 Third BMP's TN removal rate =  %  
 TOTAL TN REMOVAL RATE =  %

First BMP's TP removal rate =  %  
 Second BMP's TP removal rate =  %  
 Third BMP's TP removal rate =  %  
 TOTAL TP REMOVAL RATE =  %

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.46 + 8.3I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	<input type="text"/>	<input type="text"/>	2.60	<input type="text"/>	0.19	<input type="text"/>
Roof impervious	<input type="text"/>	<input type="text"/>	1.95	<input type="text"/>	0.11	<input type="text"/>
Managed pervious	<input type="text"/>	<input type="text"/>	1.42	<input type="text"/>	0.28	<input type="text"/>
Wooded pervious	<input type="text"/>	<input type="text"/>	0.94	<input type="text"/>	0.14	<input type="text"/>
Area taken up by BMP	<input type="text"/>	<input type="text"/>	1.95	<input type="text"/>	0.11	<input type="text"/>
Fraction Impervious (I) =	<input type="text"/>	<input type="text"/>	Pre-BMP TN Load (lb/yr) =	<input type="text"/>	Pre-BMP TP Load (lb/yr) =	<input type="text"/>
Total Area of Development =	<input type="text"/>	<input type="text"/>	Pre-BMP TN Export (lb/ac/yr) =	<input type="text"/>	Pre-BMP TP Export (lb/ac/yr) =	<input type="text"/>
	<input type="text"/>	<input type="text"/>	Post-BMP TN Load (lb/yr) =	<input type="text"/>	Post-BMP TP Load (lb/yr) =	<input type="text"/>
	<input type="text"/>	<input type="text"/>	Post-BMP TN Export (lb/ac/yr) =	<input type="text"/>	Post-BMP TP Export (lb/ac/yr) =	<input type="text"/>

***Weighted Average of Nutrient Loadings from the Catchments:***

	Catchment Acreage	Post-BMP TN Loading (lb/ac/yr)	Post-BMP TP Loading (lb/ac/yr)
Catchment 1	0.00	0.00	0.00
Catchment 2	0.00	0.00	0.00
Catchment 3	0.00	0.00	0.00
<b>TOTAL FOR DEVELOPMENT</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>

**Note:** The nutrient loading goals are 4.0 lb/ac/yr for TN and 0.4 lb/ac/yr for TP. If the post-development nutrient loading is below these levels, then the BMPs planned are adequate. Otherwise, additional BMPs and/or modifications in development plans are required.